# *DEVELOPMENT OF FEATURE SELECTION SCHEMES USING GENETIC ALGORITHMS FOR MULTI-BIOMETRIC SYSTEM*

## PROPOSAL


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***For the Degree of***

**DOCTOR OF PHILOSOPHY IN COMPUTER SCIENCE**

***Under the guidance***

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## 2016

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## 1. ABSTRACT

Feature extraction is a crucial processing stage for bio-metric identification. However, the usefulness of extracted features has been largely ignored. The extracted features might contain redundant and irrelevant features which can lead to the dimensionality problem and also may lead to degradation of the performance of biometric systems. Two solutions can be used to overcome these problems which are feature reduction and feature selection. First, feature reduction allows representing the feature vector in another vector space in order to increase the representativeness of the features and only keep the most important eigen vectors and offers a reduction of dimension in representation of the features. Among the most popular approaches of feature reduction used in biometrics, such as, linear methods such as Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA) and Kernel Linear Discriminant Analysis (KLDA) .Feature selection consists of finding the most relevant features allowing a certain objective function to be optimized. The most common approaches used in feature selection are: sequential forward selection (SFS), sequential backward se-lection (SBS), sequential floating forward selection (SFFS).

These approaches start with an initial subset and sequentially add/remove the feature that locally optimizes the objective function. In contrast, exhaustive searches are costly, time consuming and algorithmically complex. Hence, a new intelligent approaches using artificial intelligence concepts will propose to solve the problem of feature selection. For instance, for feature level fusion of fingerprint, iris and face, palm print, the Genetic Algorithm (GA) and Particle Swarm Optimization (PSO) algorithms have been used, respectively. These approaches have given promising results which motivate as to apply multimodal biometric system.

In this work, a new architecture of multi-biometric with a new feature selection scheme based on the use of the Genetic Algorithm will present.

***Keywords: Biometrics Authentication, Feature selection schemes, Genetic Algorithms, Wavelet, and Multi-biometrics.***

## 2. INTRODUCTION

Biometric using person identity traits is fast, easy-to-use, defined, reliable and cost-effective over out-dated knowledge based and token-based methods. A biometric system comprises primarily an image capturing module, a feature extraction module and a pattern matching module as shown in Figure 1. An image capturing module acquires the raw biometric data of an individual by means of a sensor. Developing seemly algorithm/s feature extraction module progresses the quality of the captured image. Whereas database module stores the biometric template information of enrolled Persons. Pattern matching module compares the extracted features with the stored templates, which in-turn generates match score [1].

The biometric systems offer numerous benefits over out-dated authentication systems. The problem of information security gives the protection of information ensuring only authorize users are able to access the information. They are required the person being authenticated to be present at the point of authentication [2]. Thus biometric-based authentication method is most secure system.

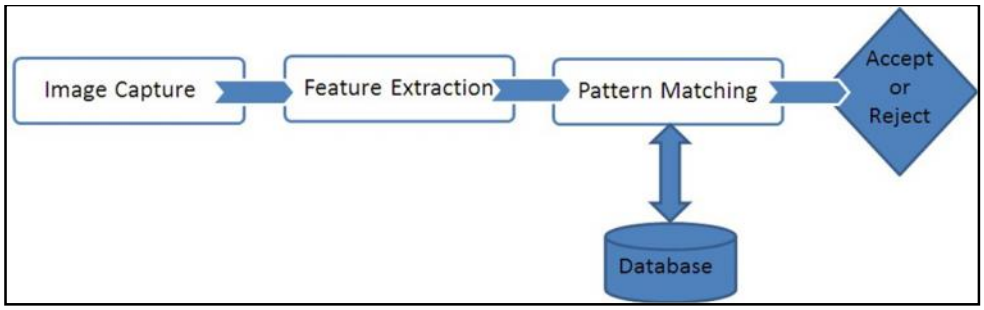


Figure 1. Biometrics System Module

The unique physical qualities of every person like finger prints, hand geometry, face, voice and iris are known as biometrics. Each biometric individual trait of a person has its strengths and weaknesses. The seemly biometric can be selected subject upon the application in numerous computer based security systems. The significant structures of the various biometrics are discussed briefly in this section.

## A.Finger Prints

The finger print of a certain individual has remained used as person identification from long period. A finger print is the outline of rids and valley on the surface of a fingertip. The finger prints of the identical twins are different. It is equitable to scan the finger prints of a certain individual and can be used in computer for numerous applications. This process is traditional and it gives accurateness for currently existing Fingerprint Recognition Systems for authentication [3]. This fingerprint recognition system is becoming within your means in a large number of uses like banking, Passport etc. Figure 2 shows a sample finger print image of a person.

Figure 2. Finger Print Image of a Person

## B.Hand Geometry

Numerous measurements are taken from the human hand to use the hand geometry recognition systems which include the shape, the size of the palm together with the length and the width of the fingers since this method is very simple and easy to use. For instance there is no influence of environment aspects such as dry weather or dry skin, this does not appear to have dry negative effects on the authentication accurateness. Also hand geometry information may not be invariant during the growth period of the children [4]. The hand geometry is scanned as shown in Figure 3 and used for identification and recognition of a person.

Figure 3. Scanned Hand Geometry

## C.Face

One of the most commonly used biometric characteristic for person recognition is the face. Recognition are based on the shape of facial attributes, such as eyes, nose, lips, eyebrows, lips, chin and the relationship of these attributes is the most popular approaches. Shown in Figure 4 are the attributes of the face image. As this technique involves many facial elements; these systems have difficulty in matching face images [5]. The face recognition systems which are used currently impose a number of restrictions on how facial images are obtained. This face recognition system automatically detects the correct face image and is able to recognize the person.

Figure 4. Face Image Recognition

## D. Voice

Voice is a mixture of physical and behavioral biometrics. The figure 5 shows a sample speech signal. The compositions of person voice are based on the vocal tracts, mouth, nasal activities and lips movement that are used synthesis of sound. These physical traits of individual's speech are never changing for every person. The behavioral part of the speech of person changes over time due to age, medical conditions, and emotional state. The speaker dependent voice recognition systems are text dependent; and the speaker independent systems are what he or she speaks [6]. The speaker dependent voice recognition system is more challenging to design but then again offers add-on protection.

Figure 5. Sample of Speech Signal

### E. Iris

The iris is genetic feature of a human. It is a distinctive structure of human which remains constant over an individual lifetime. The iris is the annular region of the eye. The left and right irises of an individual can be treated as separate distinctive identifier. A sample human eye image is given in Figure 6. The iris information can be collected by iris image. The accurateness of iris based recognition system is promising. Each iris is assumed to be distinguishing and even the irises of identical twins are also different [7]. The iris recognition system has become more users friendly and cost effective. The iris have a very low fabricated acceptance rate as compared to other biometrics like finger print, face, hand geometry and voice.

Figure 6. Sample of Human Eye Recognition

## TECHNOLOGIES

Biometric technologies are defined as “automated procedures of authenticating or distinguishing the uniqueness of a living person based on the physiological or behavioral characteristic”. A device to scan and capture a digital or analog image of a living personal characteristic, a compression, processing and comparison of the image to a database of stored images and Interface with applications systems.

### A. Genetic Algorithm (GA)

GA is an adaptive heuristic search algorithm based on the evolutionary ideas of natural selection and genetics invented by Holland [15], [18]. As such they represent

an intelligent exploitation of a random search used to solve optimization problems. GA is among the most powerful meta-heuristics used to solve binary problems.

### B. Wavelets

Wavelet technique have become one of the most important and powerful tool of image processing, so that why we will introduce the basic concept for Wavelet Transforms, the fast algorithm of Wavelet Transform, and some applications of Wavelet Transform. Wavelet appeared and was adopted in the JPEG2000 standard; suggestions for image encryption techniques based in the wavelet domain have been abundant. However, many of these are not secure as they are based exclusively on random permutations making them vulnerable to known or chosen-plaintext attacks.
Wavelets are mathematical functions that cut up data into different frequency components. Wavelet algorithms process data at different scales or resolutions. The wavelet transform carries out a special form of analysis by shifting the original signal from the time domain into the time–frequency, or, in this context, time–scale domain. The idea behind the wavelet transform is the definition of a set of basis functions that allow an efficient, informative and useful representation of images.

## 3. LITRETURE OF REVIEW

Approaches for ear feature extraction in literature can be divided into two categories: geometrical and global approaches [17].In geometrical approaches category, we cite the work of Burge and Burge [11], [10], this approach is based on building neighborhood graphs and Voronoi diagrams of the detected edges. Choras [13] proposed a geometric feature extraction method inspired by the work of Iannarelli called the Concentric Circles approach which uses a reference points for a number of concentric circles with predefined radii. The intersection points of the circles and the ear contours are used as feature points [22]. Yuan and Tian[26] applied a method that allows localising human ears form side face images named Ear Contour Detection, it is based on Edge Tracking.The Scale Invariant Feature Transform (SIFT) has been used on ear feature extraction in [9], [24], [14]. SIFT allows extracting the landmark even in images with small pose variations and varying brightness conditions [20].The

global approaches represents the second category of feature extraction approaches. A Principal Component Analysis (PCA)-based technique was applied for ear biometrics by Victor et al [24] and Chang et al [12]. The PCA-based technique uses the computed eigenvalues and eigen vectors from the set of training images to select an ear space within the largest eigenvalues. Active Shape Models (ASMs) were applied by Lu [21] to model the shape and local appearance of the ear in a statistical manner. The ASMs were used to extract ear shape features for ear biometric recognition. The Force Field Transform (FFT) was introduced by Hurley et al [16], [17], where each pixel in the image is treated as a force source directed to all the other pixels.Sana et al [23] developed a new approach for ear biometrics based on Haar Wavelets. This technique is applied after the preprocessing step and wavelet coefficients are computed, the latter allows reducing the resolution of ear image and storing only pertinent information.

## 4. SIGNIFICANCE OF THE STUDY

The existing feature selection schemes of biometrics authentication start with an initial subset and sequentially add/remove the feature that locally optimizes the objective function. In contrast, exhaustive searches are costly, time consuming and algorithmically complex. Hence, the current study aims at introducing new intelligent approaches using artificial intelligence concepts to solve the mentioned problems of feature selection. Base on the literature review, there is no study conducted for multi-biometrics system. Due to that, the current study aims at proposing a new architecture of multi-biometric with a new feature selection scheme based on the use of the Genetic Algorithm in order to provide a strong biometrics authentication system.

## 5. STATEMENT OF THE PROBLEM

Our aim is at investigation of the feature selection schemes such as sequential forward selection (SFS), sequential backward selection (SBS) and sequential floating selection (SFFS).In addition, it aims at developing these feature selection scheme based on genetic algorithms to be used in multi-biometrics system.

## 6. OBJECTIVES AND CHALLENGES

- To study feature selection schemes (SFS, SBS and SFFS).
- To present the limitations of feature selection schemes in previous works.
- To explore different schemes that used in feature selection.
- To develop different feature selection schemes based on genetic algorithms.
- To use a new feature selection scheme in multi-biometrics system (e.g. Ear and Iris …).
- To applying some variant of genetic algorithms or some recent meta-heuristic.
- To compare the existing feature selection schemes with the proposed scheme based on genetic algorithms.
- To state related factors that could be enhanced in the future.
- To give recommendations and conclusions for future enhancement.

## 7. RESEARCH METHODLOGY

- Like every biometric system, the propose system consists of three stages: processing, extraction and matching. First stage, one of enhancing images such as histogram equalization will be used to enhance the input images. Second, Using one of wavelet technology functions for extracting the features from the enhancing input images such as Gabor feature that allow an efficient, informative and useful representation of images. Thirdly, an efficient scheme for feature selection based on genetic algorithms with different data presentation such as decimal number.
- Analyzing and evaluating the different existing schemes and algorithms that are related to feature selection.
- Using any simulator in order to build a new technique/algorithm that could help on improving and defining schemes for feature selection.

- Using any simulator/tools for testing and validating the proposed schemes and technique/algorithm.

## 8. PROPOSED PLAN

### Year-wise plan of work and targets to be achieved

**Year 1:**

- Literature Survey.
- Theoretical analysis of the existing different schemes already used for feature selection.

**Year 2:**

- Developing scheme for feature selection.
- Describes an application of presented a new scheme of feature selection.
- Assessment of experimental results in terms of recognition rate.

**Year 3:**

- Interpretation of the experimental result.
- Preparation of final synopsis and thesis.
- Submission of synopsis and thesis.

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